IFW
$ AF 3726
CE

CERTIFICATE OF MAILING

I certify that I am depositing this document, and all documents identified as attachments thereto, in triplicate with the U. S. Postal Service as prepaid first class mail, on **June 30, 2004**, in an envelope addressed to Commissioner for Patents, PO Box 1450, Alexandria, VA 22313-1450.

J. Michael Neary — June 30, 2004

J. Michael Neary — Date

Inventor:	Gerald J. Julien	))Group Art Unit: 3726
Serial No.:	10/069,384	))Examiner: Eric Compton
Filed:	Feb. 19, 2002	))
Title:	"***Nitinol Bearings***"	

Brief on Appeal

June 30, 2004

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

This Brief on Appeal is being submitted in furtherance of Applicant's appeal from the final rejection of claims 1-10 and 12-20 in the Final Office Action dated January 30, 2004.

1) Real party in interest

Nitinol Technologies, Inc., assignee of this Application, is the real party in interest.

07/07/2004 SDIRETA1 00000073 10069384
01 FC:2402 165.00 OP

2) **Related Appeals and Interferences**

Applicant knows of no related interferences or appeals that would directly affect or be directly affected by or have a bearing on the Board's decision in this pending appeal.

3) **Status of Claims**

Claims 1-10 and 12-20 were rejected in the Final Office Action as noted in summary fashion below. Claim 11 was objected to. No claims have been allowed.

A. Claim 9 was rejected under 35 USC 103 as unpatentable over P/N 5,843,152 to Tu et al.

B. Claim 10 was rejected under 35 USC 103 as unpatentable over P/N 4,561,272 to Goldstein.

C. Claim 20 was rejected under 35 USC 103 as unpatentable over P/N 4,324,441 to Rouverol et al.

D. Claims 1, 5 and 7 were rejected under 35 USC 103 as unpatentable over Rouverol in view of P/N 3,283,376 to Hockin and P/N 3,422,663 to James et al.

E. Claims 2 and 6 were rejected under 35 USC 103 as unpatentable over Rouverol/Hockin/James in view of P/N 4,302,256 to Kenton.

F. Claims 3 and 4 were rejected under 35 USC 103 as unpatentable over Rouverol/Hockin/James in view of P/N 1,472,922 to Lothrop and P/N 5,928,065 to Shih.

G. Claim 8 was rejected under 35 USC 103 as unpatentable over Rouverol/Hockin/James in view of P/N 4,023,988 to Stickels et al.

H. Claims 12-15 and 17 were rejected under 35 USC 103 as unpatentable over Rouverol in view of P/N 4,216,629 to Degaeta.

I. Claim 16 was rejected under 35 USC 103 as unpatentable over Rouverol/ Degaeta in view of P/N 4,724,297 to Nielsen.

J. Claim 18 was rejected under 35 USC 103 as unpatentable over Rouverol in view of P/N 1,472,922 to Lothrop.

K. Claim 19 was rejected under 35 USC 103 as unpatentable over Rouverol/ Sommer et al in view of P/N 4,023,988 to Stickels et al.

4) Status of Amendments

On June 30, 2004, (concurrently herewith) Applicant filed a R116 Amendment. However, since this R116 Amendment has not been entered, the argument in this appeal brief will be directed at the claims rejected in the Final Rejection.

5) Summary of the Invention

A bearing having bearing elements made of Type 60 Nitinol made by an investment casting process for producing near net shape parts of Nitinol includes making a ceramic mold having a series of spherical cavities, pouring molten Nitinol into the mold cavities, cooling the mold and the Nitinol in the cavities to produce solidified Nitinol balls, and breaking the mold away from the Nitinol balls. Nitinol rods for roller bearings can be made by conventional casting directly from the crucible in a draw-down oven. The bars are hot machined or hot rotary swaged and then centerless ground and laser cut to length, or are first cut to length and then centerless ground individually for crowned roller elements. The balls are broken or cut from the risers, leaving the gates attached, and are consolidated by heating under pressure in a hot isostatic press, then ground to the desired size. The balls or rollers are polished, then treated to create an integral ceramic finish. They are then repolished to produce an extremely smooth finish. The balls can also be cut from a sheet or plate of the ball material as cubes or cylinders and processed in an abrasive tumbler to round off the

corners and edges, and the rounded cubes or cylinders can then be ground to spherical form in a conventional ball grinder.

6) Issues

A. Whether the rejection of claim 9 under 35 USC 103 as unpatentable over P/N 5,843,152 to Tu et al. was proper.

B. Whether the rejection of claim 10 under 35 USC 103 as unpatentable over P/N 4,561,272 to Goldstein was proper.

C. Whether the rejection of claim 20 under 35 USC 103 as unpatentable over P/N 4,324,441 to Rouverol et al. was proper.

D. Whether the rejection of claims 1, 5 and 7 under 35 USC 103 as unpatentable over Rouverol in view of P/N 3,283,376 to Hockin and P/N 3,422,663 to James et al. was proper.

E. Whether the rejection of claims 2 and 6 under 35 USC 103 as unpatentable over Rouverol/Hockin/James in view of P/N 4,302,256 to Kenton was proper.

F. Whether the rejection of claims 3 and 4 under 35 USC 103 as unpatentable over Rouverol/Hockin/James in view of P/N 1,472,922 to Lothrop and P/N 5,928,065 to Shih was proper.

G. Whether the rejection of claim 8 under 35 USC 103 as unpatentable over Rouverol/Hockin/James in view of P/N 4,023,988 to Stickels et al. was proper.

H. Whether the rejection of claims 12-15 and 17 under 35 USC 103 as unpatentable over Rouverol in view of P/N 4,216,629 to Degaeta was proper.

I. Whether the rejection of claim 16 under 35 USC 103 as unpatentable over Rouverol/ Degaeta in view of P/N 4,724,297 to Nielsen was proper.

J. Whether the rejection of claim 18 under 35 USC 103 as unpatentable over Rouverol in view of P/N 1,472,922 to Lothrop was proper.

K. Whether the rejection of claim 19 under 35 USC 103 as unpatentable over Rouverol/ Sommer et al in view of P/N 4,023,988 to Stickels et al. was proper.

7) Grouping of Claims

The rejected claims do not stand or fall together; that is, claims 1-10 and 12-20 are separately patentable, as explained in detail in the following Argument.

8) Argument

For simplicity of relating the summary Status of the Claims in §3 and the Statement of Issues in §6 with the related argument in this §8, the same letters used in §§3 and 6 will identify the argument sections.

A) Claim 9 was rejected under 35 USC 103 as unpatentable over P/N 5,843,152 to Tu et al. Tu discloses a medical instrument having a ball electrode 14 made of gold, platinum, silver, platinum, stainless steel, or Nitinol. Claim 9 was amended to more clearly define the claimed article for use in a ball bearing, although the Examiner declined to give the expression of intended use any patentable weight because it was in the preamble rather than the body of the claim. Tu does not teach the use of his ball electrode as a rolling element for a ball bearing, and Applicant does not believe that there is anything in any cited reference that would lead a person of ordinary skill in the art to use Tu's ball for that purpose. Moreover, Tu does not disclose a ball of Type 60 Nitinol, and there is nothing in Tu that would lead a person of ordinary skill in the bearing art or the medical instrument art to use Type 60 Nitinol instead of the usual Type 55 Nitinol (used in medical instruments and orthodontia because of its body-compatibility). Type 60 Nitinol is much more difficult to form and

machine than Type 55 Nitinol, so there would be ever incentive to use Type 55 Nitinol rather than the claimed Type 60 Nitinol. Accordingly, Applicant believes that claim 9 is allowable as amended.

B. Claim 10 has been rejected under 35 USC 103 as obvious over Goldstein. Goldstein discloses a lock shackle having a Nitinol rod 10 in the center of the composite shackle. Claim 10 has been amended to more clearly define the claimed article for use in a roller bearing. Goldstein does not teach the use of his lock shackle rod as a rolling element for a roller bearing, and Applicant does not believe that there is anything in any cited reference that would lead a person of ordinary skill in the art to use Goldstein's rod for that purpose. Moreover, Goldstein's rod is made of Type 55 Nitinol, not Type 60 Nitinol as claimed. Type 55 rod and wire are commercially available because Type 55 Nitinol is ductile enough to be drawn into wire and rod. Type 60 Nitinol, on the other hand, is not available commercially because it is so difficult to form that nobody has been able to develop a process for drawing Type 60 Nitinol. Therefore, since Goldstein does not teach Type 60 Nitinol for use in his lock shackle, and since Type 60 rod is not available commercially for use for bearing elements (or any other purpose), it would not be obvious to a person of ordinary skill in the art to use Type 60 Nitinol rod in a rolling element bearing. Accordingly, Applicant believes that claim 10 is allowable as presented.

pplicants regard as their invention.

C. Claim 20 has been rejected under 35 USC 103 as obvious over Rouverol. Rouverol teaches a rolling contact element for bearings or traction friction drive devices. The essence of Rouverol's teaching is the use of precompression of the rolling contact surface. He does mention in passing that shape memory materials are well suited to shrink-fit assemblies, and that the disadvantage of non-hardenability of nickel-titanium materials can be overcome by his prestressing techniques, which he discloses in great detail. In fact, Applicant has found that Type 60 Nitinol makes excellent bearing materials without prestressing. Applicant has attempted to claim this distinction in amended claim 20.

The Examiner asserts that the use of Type 60 Nitinol would have been obvious to one of ordinary skill in the bearing art because "it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice." Applicant denies that the use of Type 60 Nitinol would have been obvious to a person of ordinary skill in the art. It is so difficult to work and machine and grind that there is almost no use made of this material at present, and at the time of this invention, there was no other use made of this material other than the use by Applicant. Because of Applicant's developments, Type 60 Nitinol is beginning to be recognized as a material with attractive properties, but at the time this invention was made, there was no use made of this material at all and it was not commercially available. Indeed, Applicant had to teach the foundry how to make Type 60 Nitinol so that he could acquire enough stock to conduct his development activities. Therefore, the *In re Leshin* decision is not applicable to the situation in which the suitability of the material is off-set by its well-known disadvantages and commercial unavailability because of those known disadvantages.

The Examiner cites Ex parte Masham for the proposition that "the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations." Applicant asserts that Ex parte Masham is inapposite because Rouverol does not teach an annular ring of Type 60 Nitinol, and specifically teaches away from Applicant's claied limitation that the annular ring of Type 60 Nitinol is free of substantial compressive prestress. Therefore, Applicant believes that claim 20 is patentable over Rouverol.

D. Claims 1, 5 and 7 were rejected under 35 USC 103 as unpatentable over Rouverol in view of P/N 3,283,376 to Hockin and P/N 3,422,663 to James et al. Claim 1 defines a casting process for making Nitinol rolling bearing elements of a desired shape, such as balls or rods. A ceramic mold is made having a cavity with an internal shape like the desired shape of the rolling bearing elements. Molten Nitinol is poured into the cavity and is cooled Nitinol in the cavity to produce a solidified Nitinol

form having the desired shape. The mold is then disintegrated to remove the Nitinol form.

Rouverol teaches the use of prestressing rolling surface elements made of steel, glass-reinforced plastics, aluminum and bronze alloys, chilled cast iron, and "shape memory" materials. He does not mention Nitinol specifically, but he does mention nickle-titanium, which probably means Nitinol. He requires prestressing of the nickle-titanium materials because it overcomes "the disadvantage that nickle-titanium is not hardenable". Rouverol does not teach the use of Nitinol for the actual rolling elements themselves, because of his requirement that the Nitinol parts be under a state of pre-compression. Therefore, balls for ball bearings, and rollers for roller bearings could not be made of Nitinol according to the teachings of Rouverol. Therefore, it would not have been obvious to a person of ordinary skill in the art to attempt to make rolling elements for rolling element bearings out of Nitinol according to Rouverol, because of the impossibility of making maintaining a condition of pre-compressive stress on the rolling elements.

Hockin discloses an investment casting process for "wear resistant alloys such as cobalt and similar base alloys." However, he does not disclose that it can be used to cast Nitinol. In fact, to Applicant's knowledge, before his invention, no articles were ever cast from Nitinol using a casting process like Hockin's process. Applicant believes that, even though Nitinol was invented in the early 1960's, and Hockin's patent issued in 1966, the fact that nobody in the art, skilled or unskilled, ever tried to cast Nitinol balls is an indication that the process was unobvious to those skilled in the art. It was known that Nitinol needed to be hot worked and/or cold worked to obtain the desired properties, and it is impossible to hot work or cold work a part that is investment cast to finished shape. Therefore, the casting of Nitinol to make parts to finished shape would not have been obvious to a person of ordinary skill in the art.

Claim 5 calls specifically for Type 60 Nitinol to be used to make the balls. It was long believed, prior to Applicant's developments with Type 60 Nitinol, that it was too brittle for use in any type of structural application. A broken ball of Type 60 Nitinol would cause catastrophic failed of a bearing, and that may be one reason why nobody ever attempted to make balls of Type 60 Nitinol.

Claim 7, dependent on claim 5, further calls for grinding the balls to smooth spheres of the desired diameter. Hockin teaches that his process produces a sufficiently smooth surface of a dimensional tolerance which eliminates grinding of the gate area. Applicant's process as defined in claim 7 specifically calls for grinding the balls to the desired diameter, which is specifically contrary to Hockin's teaching. Therefore, the combination of Rouverol and Hockin would not lead a person of ordinary skill in the art to make the invention claimed in claim 7.

E. Claims 2 and 6 were rejected under 35 USC 103 as unpatentable over Rouverol/Hockin/James in view of P/N 4,302,256 to Kenton.

Claim 2 calls for subjecting the Nitinol form, after removal from the mold, to hot isostatic pressing at about 1650°F and 20,000 psi for about 2 hours. Kenton teaches hot isostatic pressing to remove casting imperfections in a variety of age-hardenable metal alloys, including alloys containing titanium, and other alloys containing nickel, but not nickel-titanium materials. Nitinol is not age hardenable, so the teachings of Kenton do not apply to Nitinol castings by Kenton's own teaching. The process parameters he specifies for the different alloys are all different, and he does not specify any parameters for Nitinol, even though Nitinol was well known at the time Kenton made his invention. This is understandable since it was not know that Nitinol could be cast into shapes until Applicant did it for the first time in the course of making this invention, and also because Kenton's invention applies only to age hardenable metal alloys, and Nitinol is not age hardenable, and in fact is not even an alloy at all; it is an intermetallic. Therefore, Kenton's teachings, by their own limitations, do not apply to Nitinol and Kenton would not lead a person of ordinary skill in the art to use hot isostatic pressing on Nitinol castings, even if it were obvious to make castings of Nitinol in the first place.

Claim 6 calls for subjecting the Nitinol branch of connected balls to hot isostatic pressing at about 1650°F and 20,000 psi for about 2 hours. None of the references cited against this claim, including Kenton, teaches that the balls remain connected to the branch during hot isostatic pressing. It would be most logical to remove the balls from the branch before placing in the HIP autoclave for convenience and economy of

packing the most balls into the autoclave, but claim 6 takes the opposite approach to this more logical approach. Therefore, the process defined in claim 6 would not have been obvious to a person of ordinary skill in the art.

The Examiner cites *In re Boesch* for the proposition that the discovery of an optimal value for a result-effective variable involves only routine skill in the art. Applicant would concede that this general proposition is true in some cases, but is not always true. Specifically, Applicant submits that it is not true in the case of claims 2 and 6. The result-effective variables disclosed in Kenton are not disclosed as effective for Nitinol, so they are not result-effective variables in the context of claims 2 and 6. Moreover, Kenton discloses a huge range for all three variables of time, temperature and pressure. The process of determining the correct combination of variables from all the possible combinations would involve making a near infinite number of test samples and then testing and otherwise analyzing each test sample. It is easy for Examiners in the Patent Office to reach the breezy conclusion that all of this would be obvious, but to a person of ordinary skill in the art who is required to operate in the real world with real economic restraints on his time and resources, the prospect would be insuperably daunting, especially since he would not even have any certainty that hot isostatic pressing would be effective for Nitinol since it is not among the many materials disclosed by Kenton for which is process is effective, it is not an age-hardenable alloy, and in fact is not an alloy at all. Therefore, Applicant believes that *In re Boesch* does not apply in the case of claims 2 and 6 and that these claims are patentable over the combination of Rouverol, Hockin, James, and Kenton.

F. Claims 3 and 4 were rejected under 35 USC 103 as unpatentable over Rouverol/Hockin/James in view of P/N 1,472,922 to Lothrop and P/N 5,928,065 to Shih.

Claim 3 specifies that the rolling bearing element is a cylindrical roller bearing roller and the Nitinol form is a rod. The rod is centerless ground to the desired maximum diameter of the roller elements, and then is cut to individual rollers about the length of the roller bearing elements.

Lothrop teaches a process for making roller bearing cups, not roller bearing rollers. Roverol teaches a process for making balls, not rollers for a roller bearing. Shih teaches a process for truing and dressing the grinding wheels on a centerless grinding machine. However, Shih does not teach that Nitinol can be ground in a centerless grinder, and in fact, Nitinol is very difficult to grind or cut in any way. Applicant's first attempts at having Nitinol centerless ground at a machine shop specialized in centerless grinding were disastrous. The owner told Applicant that the parts ruined his grinding wheels and that he refused to take any more work from Applicant. Accordingly, the Examiner's assumption that it would have been obvious to use the centerless grinding machine shown in Shih is not supported by Applicant's experience.

Claim 4 calls for centerless grinding the individual rollers to the desired diameter and profile of said roller elements. Neither Lothrop nor Shih teach the use of centerless grinding to finish grind roller bearing rollers after they are cut from a rod of Nitinol that has been centerless ground to near net size. This is a two-step process that produces very highly accurate parts very economically. It is not taught by any conceivable combination of Rouverol, Hockin, James, Lothrop and Shih.

G. Claim 8 was rejected under 35 USC 103 as unpatentable over Rouverol/Hockin/James in view of P/N 4,023,988 to Stickels et al.

Claim 8, dependant on claim 5, calls for heating the balls to about 950°C and liquid quenching to harden the balls to about 62RC and produce a hard integral oxide surface on said balls.

Stickels teaches a heat treatment process for hardening steel balls. Stickels teaches nothing about heat treating Nitinol. The Examiner appears to assume that the temperatures and heating schedules for heat treatment of steel also apply to all other materials. Applicant asserts that a person of ordinary skill in the art of heat treatment knows full well that each material requires its own heat treatment process and that the details of heat treatment of one particular type of steel, as disclosed in Stickels, does not apply to other types of steel, much less to other materials.

Rouverol teaches that Nitinol is not hardenable. Therefore, the combination of Rouverol and Stickels is that steel balls are hardenable but that Nitinol is not hardenable and must be maintained in a pre-stressed condition to be usable in a bearing application. Therefore, these reference present a compelling case for the proposition that Nitinol balls are not suitable for ball bearings and that steel balls must be used. They stand for a teaching exactly the opposite from the conclusion that the Examiner has reached with the benefit of Applicant's disclosure.

H. Claims 12-15 and 17 were rejected under 35 USC 103 as unpatentable over Rouverol in view of P/N 4,216,629 to Degaeta.

Claim 12 defines a process for making balls out of a material such as Nitinol that is difficult or impossible to form into a ball. A sheet or plate of the material from which the ball is to be made is selected and ball blanks are cut out of the sheet. Those ball blanks are ground in a ball grinder to a desired spherical shape and size.

Degaeta teaches a process of producing generally spherical balls suitable for finish grinding in a ball grinding machine. Cylindrical blanks are cut from steel wire, such as 440C stainless steel, and are processed in Degaeta's apparatus to round off the corners or edges to produce ball blanks that are spherical enough to be ground to finished shape in a ball grinder. The ball blanks are heat treated to full hardness before finish grinding in the ball grinder.

Degaeta also teaches the use of cubical blanks of "glass, ruby, silicon nitride, and other materials which by reason of being frangible could not be shaped by the "flashing operation heretofore applied to soft metal slugs." He does not teach that blanks could be cut from a sheet of material.

The Examiner asserts that it would be obvious to a skilled artisan to cut cubical blanks out of a sheet of material having the desired cross-section to reduce waste. In fact, cutting the blanks from wire or rod involves the lease possible waste. Cutting the blanks out of a sheet wastes the material that is removed in the kerf. Therefore, the motivation cited by the Examiner for his proposed modification of Degaeta does not exist and indeed is a disincentive for making the proposed modification. Moreover, the cutting of blanks out of a sheet of material is much slower and more costly that the fast

and cheap process of feeding wire into a chopper and chopping the ends of the wire off in a rotary chopper. Therefore, even it there were some reason for a person of ordinary skill in the art to consider cutting cubical blanks out of a sheet of material, he would immediately discard the idea as inferior to the standard process because, compared to the standard process, it slow, costly, inefficient and wasteful of material. Accordingly, Applicant believes that claim 12 is patentable over the combination of Rouverol and Degaeta.

Claim 13 specifies that the blanks are cubical in shape. Degaeta does mention cubical blanks of "glass, ruby, silicon nitride, and other materials which by reason of being frangible could not be shaped by the "flashing operation heretofore applied to soft metal slugs." Nitinol is not frangible, so the cubical form taught by Degaeta does not apply, according to his own criterion for using the cubical shape for the blanks.

Claim 14 specifies that the ball blanks are cylindrical in shape. Degaeta's blanks are indeed roughly cylindrical in shape, but if a person of ordinary skill in the art thought to make balls for ball bearings out of Nitinol (absent any teaching whatsoever in the art to do so), and attempted to use the process taught by Degaeta to make cylindrical ball blanks out of Nitinol wire, he would very quickly abandon the attempt when he found that Nitinol is so hard to shear in the wire chopper that his chopper blades needed replacement so often that he would be unable to get anywhere near the production throughput to make an efficient process.

Claim 15 calls for the ball blanks to be cut out of the sheet or plate by an industrial cutting laser. Neither Rouverol nor Degaeta disclose a single word about laser cutting. Applicant denies that laser cutting cubes out of a sheet of material would be obvious to a person of ordinary skill in the art in view of references that neither disclose laser cutting nor appear to have a need for laser cutting.

Claim 17 calls for tumbling the ball blanks in and abrasive tumbler to round off corners and edges of said ball blanks prior to grinding said ball blanks in said ball grinder. Degaeta does not disclose a tumbler. He discloses several tubular containers over a grinding disc. There is doubtless a degree of circulation of the ball blanks within the tubular containers, but it is not a conventional tumbler as Applicant disclosed, wherein the rounding of the cubes is accomplished by the action of the

abrasive grinding media and the cubes against each other. Therefore, Degaeta does not disclose a process as defined in claim 17, so claim 17 should be patentable of the combination of Rouverol and Degaeta.

I. Claim 16 was rejected under 35 USC 103 as unpatentable over Rouverol and Degaeta in view of P/N 4,724,297 to Nielsen.

Claim 16, dependant on claim 12, calls for said ball blanks have a center and six equal orthogonal dimensions through said center.

Nielsen teaches a method of laser cutting metallic workpieces. Clearly, Nielsen teaches nothing about ball blanks. Applicant's response to the first Office Action suggested that the Examiner might have confused claims 15 and 16, since claim 15 does indeed claim the use of an industrial cutting laser to cut the ball blanks out of the sheet of material. However, the Examiner merely repeated the same rejection using the same words in his Final Office Action. Applicant is now confused as to exactly what the Examiner intended to do. Does he really intend to reject claim 16 using a reference that has nothing to do with the claim, or does he intend to reject claim 15 over that combination of references.

Assuming that the Examiner intended to reject claim 15 over the combination of Rouverol, Degaeta, and Nielsen, Applicant will address that assumed rejection. Nielson is cited as a teaching of the use of laser cutting and for the advantage of the absence of burrs. In fact, burrs are of no concern in the claimed process because the burrs grind off very easily and quickly in the abrasive tumbler. The real benefit of laser cutting is its speed and the very narrow kerf it makes, avoiding the waste of other processes (such as abrasive waterjet) that produce a somewhat wider kerf. However, current laser cutting apparatus is expensive, so these advantages are offset by the lower cost of waterjet cutting. In any case, the benefit cited by Nielson is of no consequence in Applicant's process. Moreover, Rouverol does not teach Nitinol rolling elements for ball bearings, and Nielsen does not teach that his laser cutting process will actually work to cut Nitinol sheet. Finally, it is known that Nitinol is adversely affected by even small amounts of absorbed oxygen, and Nielsen's process using oxygen in the gas could adversely affect the properties of the

resulting Nitinol balls, especially since oxygen absorption is accelerated at higher temperature, such as the temperature in a laser kerf. If a person of ordinary skill in the art were to assemble the references that the Examiner has assembled and conceive of their use as the Examiner has proposed it (and Applicant very much doubts that a person of ordinary skill in the art would conceive of such a thing, as noted above) then this person of ordinary skill in the art would reject the use of Neilsen's laser because of the likelihood that the oxygen content of Neilsen's gas would be damaging to the desired properties of the Nitinol in the balls.

J. Claim 18 was rejected under 35 USC 103 as unpatentable over Rouverol in view of P/N 1,472,922 to Lothrop (and Sommer is also cited.)

Claim 18 calls for a process for making Nitinol bearing races, including selecting a tube made of Type 60 Nitinol. Rouverol does disclose a roller bearing in his Fig. 13 having rolling surface elements 135 and 135 made of shape-memory materials that can be prestressed. However, Rouverol does not specify Type 60 Nitinol, and does not disclose how such elements could be made.

Lothrop teaches a process of drilling a bar A of material to make a tube B. The tube is then cut off in the form of annular rings D. The rings are then placed in a die and upset to cause the material to flow and conform to the desired conical shape of the roller bearing race.

There is nothing in Rouverol or Lothrop that would teach a person of ordinary skill in the art how to select a tube made of Type 60 Nitinol. In fact, tubes of Type 60 Nitinol are not available anywhere in the world. Applicant has disclosed one process for making tubes of Type 60 Nitinol, but to Applicant's knowledge, there are no type 60 Nitinol tube available to "select". Therefore, it would not be obvious to one skilled in the art to select a tube made of Type 60 Nitinol if such a tube is not available.

The process taught by Lothrop of drilling a bar of Type 60 Nitinol would not work. Type 60 Nitinol is nearly impossible to drill without the preparation taught by Applicant, and Type 60 Nitinol is not available in bar form. Thus, a person of ordinary skill in the art would not even begin to make the invention defined in claim 18 because the starter materials are not available and he would have no way of obtaining them. A

person of ordinary skill in the art would not waste his time attempting to make something when the materials are not available, so the invention defined in claim 18 would be unobvious to a person of ordinary skill in the art.

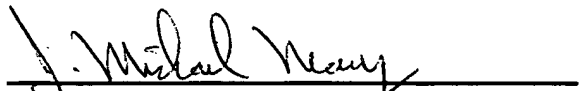
Sommer teaches a method of centrifugal casting steel bearing races. Sommer does not teach making Nitinol races with the centrifugal casting process, or that Nitinol could be cast using that process, or any of the heat treating detail that are used to produce desirable properties in the resulting article. Thus, Applicant believes that Sommer is not an enabling teaching of the claimed process.

K. Claim 19 has been rejected under 35 USC 103 as obvious over Rouverol and Sommer in view of Stickels. Stickels teaches a process for heat-treating SAE 52,200 steel. Applicant asserts that the teaching would be known to a person of ordinary skill in the art to be applicable only to steel, and to SAE 52,200 steel in particular, and not to other materials, especially not to non-iron based materials. Thus, Stickels would not be regarded by a person of ordinary skill in the art to be an enabling teaching that would be applicable to Nitinol. Therefore, the combination of Rouverol, Sommer, and Stickels would not lead a person of ordinary skill in the art to make the invention claimed in claim 19.

Accordingly, Applicant believes that the claims now pending in this Applicantion are all patentable over the combinations of references cited by the Examiner and respectfully request that the Board reverse the Examiner's rejections and return this Application to him to issue this Application.

Respectfully submitted,

542 SW 298th Street
Federal Way, WA 98023
Telephone: (253) 941-7683
FAX: (253) 941-3623
E-mail: Nearypatents@MSN.com



J. Michael Neary, Reg. No. 25,453
Attorney for Applicant

9) Appendix

1. (Original) A process for making Nitinol rolling bearing elements of a desired shape, comprising:

making a ceramic mold having a cavity with an internal shape like said desired shape of said rolling bearing elements;

pouring molten Nitinol into said cavity;

cooling said mold and said Nitinol in said cavity to produce a solidified Nitinol form; and

disintegrating said mold to remove said Nitinol form .

2. (Original) A process as defined in claim 1, further comprising:

after removal of said Nitinol form from said mold, subjecting said Nitinol form to hot isostatic pressing at about 1650°F and 20,000 psi for about 2 hours.

3. (Original) A process as defined in claim 1, wherein said rolling bearing element is a cylindrical roller bearing roller and said Nitinol form is a rod, and further comprising:

centerless grinding said rod to the desired maximum diameter of said roller elements; and;

cutting said rod to individual rollers about the length of said roller bearing elements.

4. (Original) A process as defined in claim 3, further comprising:

centerless grinding said individual rollers to the desired diameter and profile of said roller elements.

5. (Original) A process for making Nitinol ball bearing elements, comprising:

making a ceramic mold having elongated branches with spherical ball cavities therein;

pouring molten Type 60 Nitinol into said mold and allowing said molten Nitinol to flow into and fill said spherical ball cavities;

cooling said mold and said Nitinol in said mold to produce a solidified branch of connected Nitinol balls;

breaking said mold away from said Nitinol balls; and

separating said balls from said branch.

6. (Original) A process for making Nitinol ball bearing elements as defined in claim 5, further comprising:

after removal of said Nitinol branch of connected balls from said mold, subjecting said Nitinol branch of connected balls to hot isostatic pressing at about 1650°F and 20,000 psi for about 2 hours.

7. (Original) A process for making Nitinol ball bearing elements as defined in claim 5, further comprising:

grinding said balls to smooth spheres of the desired diameter.

8. (Previously Amended) A process as defined in claim 5, further comprising:

heating said balls to about 950°C and liquid quenching to harden said balls to about 62RC and produce a hard integral oxide surface on said balls.

9. (Previously Amended) A Nitinol ball bearing element for use in a ball bearing for supporting a rotating shaft, comprising:

a sphere of Type 60 Nitinol.

10. (Previously Amended) A Nitinol roller bearing element for use in a roller bearing for supporting a rotating shaft, comprising:

a rod of Type 60 Nitinol.

11. (Previously Amended) A process as defined in claim 1, further comprising:

heating said Nitinol form to an elevated temperature in a range of about 800°C-950.C and rotary forging said Nitinol form at said elevated temperature to produce a hot-worked rod having a diameter slightly greater than the desired diameter of said rolling bearing elements.

12. (Original) A process for making balls out of a material such as Nitinol that is difficult or impossible to form into a ball, comprising:

selecting a sheet or plate of said material;

cutting ball blanks out of said sheet or plate; and

grinding said ball blanks in a ball grinder to a desired spherical shape and size.

13. (Original) A process as defined in claims 12, wherein:

said ball blanks are cubical in shape.

14. (Original) A process as defined in claim 12, wherein:

said ball blanks are cylindrical in shape.

15. (Original) A process as defined in claim 12, wherein:

said ball blanks are cut out of said sheet or plate by an industrial cutting laser.

16. (Original) A process as defined in claim 12, wherein:

said ball blanks have a center and six equal orthogonal dimensions through said center.

17. (Original) A process as defined in claim 16, further comprising:

tumbling said ball blanks in and abrasive tumbler to round off corners and edges of said ball blanks prior to grinding said ball blanks in said ball grinder.

18. (Previously Amended) A process for making Nitinol bearing races, comprising:

selecting a tube made of Type 60 Nitinol and having a central axis;

cutting bearing race blanks off said tube on a cutting plane perpendicular to said central axis; and

grinding or machining said race blanks to desired outside dimensions and interior configuration.

19. (Original) A process as defined in claim 18, further comprising:

heat treating said race blanks to about 900°C and quenching to produce hardness of above about 58RC.

20. (Previously Amended) A bearing race for a rolling element bearing, comprising:

an annular ring of Type 60 Nitinol free of substantial compressive prestress.